Continuity in Dynamic Coalition Operations[1]

Track: Coalition Interoperability

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Continuity in Dynamic Coalition Operations

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Abstract

The combination of participating organizations in a coalition operation often changes over time; the coalition is dynamic and evolves over the course of its mission. A given organization may participate in the coalition only at the stage where its expertise or resources are most needed, while other organizations may participate through the entire course of the operation. As these are independent organizations coming together for a limited time to meet a specific goal, the structure of the coalition must be able to accommodate the different command arrangements, procedures, and other characteristics of each organization. In order to develop a theory of a coalition structure that can accommodate the changing needs of the coalition, a dynamic model of a coalition is being developed that allows organizational participation to fluctuate over the course of the mission. In order to ensure that the model emulates real world situations, a scenario was created from actual coalition experiences in the NATO-led Balkan's peacekeeping operations in Kosovo, where lead nations were assigned under the operational command of the NATO-led force. Adding to the complexity of the operations was the fact that military commanders and staff turned over frequently creating stability and continuity of operations challenges. This project attempts to capture some of these dynamics in order to draw conclusions about the effect of change on the coalition structure.

Introduction

The goal of the Adaptive Architectures for Heterogeneous Command Centers project is to design coalition command centers that can adapt within a multinational environment. As a coalition mission evolves, the cooperating command centers may need to adapt in order to complete the prescribed mission. The cooperating command centers can adapt internally within each command center or externally through interactions with the other cooperating command centers. Part of this adaptation occurs naturally through the evolution of the coalition structure: cooperating command centers may join or leave the coalition as it evolves over time due to changes in the mission or due to changes internal to the command center. By using a dynamic model of the coalition architecture, adaptation strategies can be identified at both the individual command center and the coalition level, and used to design organization architectures that are adaptive.

In a coalition, the cooperating command centers are heterogeneous, reflecting differences in their organizational structures, military procedures, command and control processes, and culture. The coalition structure must cope with the needs of these heterogeneous

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partners. Handley and Levis [2001] examined the effect of heterogeneity on the interactions between nodes of the cooperating command centers and used a model to simulate the effect of these interactions on coalition performance. The cooperating command centers may also have systems of different capabilities. Different task assignment strategies, based on functional or geographic requirements, can be used to assign coalition tasks to the participating command centers; including these different strategies in the coalition model resulted in different levels of collaboration among the cooperating command centers and different levels of coalition performance [Handley, 2002].

The current research objective focuses on the dynamic changes that occur in a coalition's structure over the course of the mission. These changes may impact both collaboration and interoperability, as the links between the cooperating command centers are changing. A dynamic model of a coalition is being developed that can represent the dynamic structure of the coalition by allowing changes to the nodes and monitoring the effect of these changes on the characteristics of the links. By modeling how the links between command center nodes change over time, rules and representations for the interactions among cooperating command centers can be created and a theory developed on how coalitions adapt over the course of the mission.

The NATO-led Kosovo Force (KFOR) multinational peace support operation in Kosovo was chosen as a real world case study because it offered an interesting command structure. It was essentially an alliance operating as a coalition where the KFOR headquarters was based on NATO alliance structures and processes and the supporting multinational military operations, referred to as Multinational Brigades (MNBs), functioned as lead nation structures reporting to the KFOR commander. The diversity of the coalition increased the likelihood of problems; these different organizational cultures must be accommodated within the coalition structure to enable mission participants to work with unified effort to meet mission objectives.

Multinational Coalition Characteristics

Multinational operations tend to be categorized into one of two major groups, either a coalition or an alliance. Since no single command structure fits all needs of both groups, in reality different structures evolve to meet the needs of the specific real world operation. Coalitions normally form as a rapid response to an unforeseen crisis. The use of a parallel command structure often emerges as the preferred command arrangement because it is the simplest to establish. Under a parallel command structure, the participating militaries retain control of the activities of their forces. Because there is no unity of command under this arrangement, a mechanism is put in place to coordinate the parallel activities in order to achieve unity of effort. As the coalition operation matures, a lead nation usually emerges to take command of the operation. A lead nation can also be assigned at the outset of the operation as well. For a lead nation arrangement, the command structure recognizes that one nation is assigned the lead role and its command and control structure and processes predominates. The participating nations provide liaison personnel to the headquarters operation and the lead nation commander works in

consultation with the participating nation's commanders. Depending on the size and nature of the operation, multinational staff augmentation of the lead nation headquarters may be employed as well. In both the parallel and lead nation structures, robust liaison is essential to develop and maintain unity of effort.

In the case of an alliance, the headquarters is an integrated command structure with a single designated commander, the staff is composed of representatives from all member nations, staffs are integrated at echelons above corps (EAC) and national armies are responsive to the multinational commander. Under this arrangement, there can also be multinational command and staff arrangements at corps and below. The alliance's military structure and processes predominate at the EAC levels. This arrangement provides for achieving unity of command in a multinational operational environment. The NATO command structure is an example of such an arrangement and was the basis for the NATO-led command arrangements employed in the Balkans peace operations, e.g., KFOR command arrangements.

Peace operations involve subtle missions and complex civil-military relationships. Understanding the relationships and motivations of the actors on the peace operations landscape requires an understanding of the complex dynamics at work. The realities of the situation are that there are many actors with hidden and sometimes competing agendas and no one is clearly in charge. The civil agency implementation activities tend to lag the military, placing a dependency on the military to fill the gap until the civil agencies can get established and assume their appropriate responsibilities - referred to by the military as "mission creep." The end state will be politically driven and purposely vague. There will be a lack of shared understanding between the civil and military actors of the situation and of each other's roles. Expectations will not be managed very well and ad hoc arrangements will dominate. Information sharing and collaboration among the civil-military actors will be problematic. Trust will be a fundamental source of tension.

The decision to intervene in a conflict is political. The military mission in support of the intervention reflects the political process. Military support to such operations is just that, a military operation. The military's function is to create a safe and secure environment. The military also provides assistance as appropriate and necessary to the International Organizations (IO) and Non-Governmental Organizations (NGO). They are not there, however, to do the jobs of these organizations. Additionally, the principles of peace operations are fundamentally different from those of war-fighting. They include: unity of purpose not unity of command, consensus planning not hierarchical decision making, simplicity to ensure consensus can be built and unity of effort achieved, adaptive control to meet the passive and reactive nature of the operations, and transparency of operations rather than surprise and security. A variety of "stove-piped" independent and separately managed civil and military communications and information systems (CIS) populate today's complex peace operation battlefields. Therefore, there are interoperability and information sharing challenges and security disconnects that need to be dealt with. This is simply the reality of coalition operations and the difficult challenges faced by those who deploy and manage these networks.

The Coalition Model Design

In order to model the coalition structure, it must be described in such a way that it can be incorporated into a model. “Ultimately, organizations manifest themselves as organization charts. To formalize the process of building these charts, they are considered in terms of graph theory” [Chamberlain, 1999]. Graph theory can be used to represent the coalition’s organizational structure. A graph is composed of nodes and links, i.e. vertices and edges. The nodes represent the billets filled by the decision makers in the coalition command center, i.e., the boxes in the organization chart. The links represent the interconnections between the nodes, which can be the formal command relationships indicated in the organization chart, or the links can also indicate other interconnections, such as communication networks and social relationships.

Since the coalition structure is defined as a set of billets (nodes) and the set of relationships between them (links), change to the structure can be implemented as a change to the set of nodes and the impact of this change can be measured by the effect on the links. Usually a billet (or a box on the organization chart) is not added or deleted, but rather the “occupant” of the box, or in this case the decision maker assigned to the billet, is changed. This change in personnel modifies the attributes associated with that billet. For example, in a coalition an important attribute of each node is the language spoken by the decision maker. When a change is made to the decision maker assigned to a billet, the language attribute of that node may change. This change to the node then causes modifications to the set of links that the node is involved in, i.e., the change in the language attribute may cause the communication ability of some links to change. Changes in the node are reflected as changes on the links and conclusions can be drawn concerning how these changes affect factors such as collaboration and interoperability.

The dynamic coalition model is part of a larger model development for studying heterogeneous command centers. A complete description of the coalition model can be found in Handley and Levis [2001]. The model is implemented with Colored Petri nets, which are bipartite directed graphs that can represent the dynamic behavior of a system. For a complete description of Colored Petri nets, see Jensen [1992]. A portion of the current model, the Coalition Status, is shown in Figure 1. This section of the model updates the attributes of the node that is changed, finds the set of links that the node is involved in, and updates the links’ attributes. When a change is made to a node, i.e., a decision maker is changed, the node attributes are updated with the new information. Next, the set of links that contain the changed node is identified. Each link within the set is then retrieved and a link strength measure, a user-defined link characteristic, is updated by comparing each attribute of the assigned nodes; the link strength measure indicates how many of the attributes of the two nodes are identical. The model can then sort the links based on the link characteristic after each update. The impact of the change of a node can then be gauged by the number and type of link characteristics affected by the change.

The user defines the attributes that are monitored by the model. In this case the node attributes of interest are nationality, service, and alliance. Nationality refers to the home

nation of the decision maker, the service is the branch of military service (Army, Air Force, Navy, etc.) that the decision maker is assigned to, and alliance refers to whether the decision maker's command is a member of the NATO alliance. The links also have user-defined attributes that are dependent on the node attributes, in this case the link strength measure has been defined to indicate the compatibility of the attributes of the nodes. The links may also have attributes of their own, such as type of command authority. These link attributes help trace link types through the coalition structure and can be used to trace the effect of the node change throughout the organization.

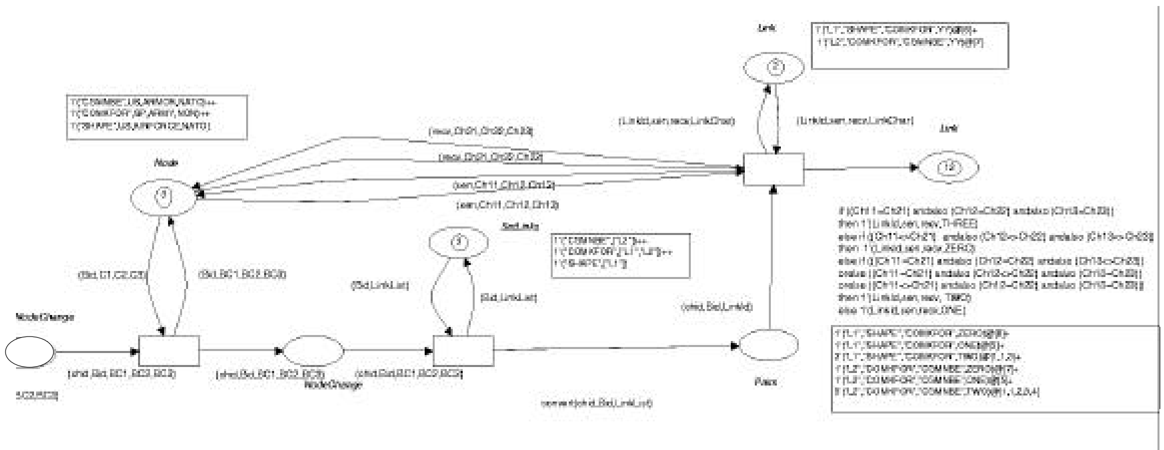

Figure 1: Colored Petri net model

One of the key issues of changing participation in the coalition command structure is compartmentalization, or clusters of similar nodes. Compartmentalization refers to having homogenous sections within the heterogeneous coalition structure. The model can be used to identify clusters by characteristic, such as nationality, military service or NATO alliance by sorting the links based on their attributes. Compartmentalization, which may be important for security, may change over time as a result of the changes in the coalition structure. But while compartmentalization may improve security, it also may prevent sharing strategic and tactical information in a timely manner and often places one compartment in a position of information control. This forces information to travel up an information chain and then back down a chain of command. In order to ensure that information flows horizontally and vertically throughout the command and control structure, certain points of interaction between these compartments may be necessary for effective flow of information; this can be accomplished by identifying nodes with certain attributes.

Kosovo Force Command Arrangements

The initial elements of the NATO-led peace support operation entered Kosovo at 0500 on 12 June 1999. As agreed in the Military Technical Agreement, the deployment of the KFOR forces was synchronized with the departure of Serb security forces from Kosovo that had started on 10 June. At 1200 hours on 20 June, the Serb withdrawal was completed and KFOR was well established in Kosovo.

The KFOR headquarters was established under a NATO assigned commander. Kosovo was divided into five sectors and national contingents were grouped into five multinational brigades (MNB) and assigned to the sectors. The MNBs were led by the NATO member nations: US, UK, France, Germany and Italy. The member NATO nations were assigned lead nation responsibilities for each multinational brigade and the brigades had both member nation and non-NATO nations forces assigned to them. Although brigades were responsible for a specific area of operation, they all fell under a single NATO chain of command under the authority of Command KFOR. This meant that all national contingents pursued, as a minimum, the same objective to maintain a secure environment in Kosovo and did so with professionalism and in an even-handed manner towards all ethnic groups. On the other hand, there were also parallel national chains of command that influenced decision making at all levels and within the NATO and national command structures. There were bypasses in levels of command as well, e.g., SACEUR provided strategic direction to commander KFOR, bypassing commander AFSOUTH. Although commander KFOR had Operational Control, in reality, because of vague definitions of NATO C2 states of command and national influences, his command authority was essentially reduced to consensus building and coordination of the independent actions of the MNBs.

The KFOR command underwent a number of changes after its arrival. The initial KFOR deployment was under the command of the Allied Command Europe Rapid Reaction Corps (ARRC) and headed by British Lt General Sir Michael Jackson. The principal mission under the command of the ARRC was to establish rule of law and a secure environment to allow for the safe return of Kosovar refugees. General Jackson handed over the command to German General Klaus Reinhardt of Allied Land Forces Central Europe (LANDCENT) in October 1999. Under LANDCENT command, the KFOR mission of maintaining a safe and secure environment and assisting with the safe return of refuges and internally displaced persons continued but emphasis was also placed on humanitarian assistance to provide food, shelter and clothing for the winter months. After six months, in April 2000, General Reinhardt handed over the command to Spanish Lt General Juan Ortuno, commander of the five-nation European military force, EUROCORPS. General Reinhardt was both politically and military mission focused and was a strong proponent of civil-military collaboration and information sharing. General Ortuno tended to be more politically focused and under EUROCORPS there seemed to be less emphasis on collaboration and coordination which drove the MNBs to function even more independent of each other and hence, with less cross-MNB collaboration and cooperation. In October 2000, command of KFOR was turned over to Italian Lt General Carlo Cabigiosu from Allied Forces Southern Region (AFSOUTH).

Supreme Headquarters Allied Powers Europe (SACEUR) delegated authority for the KFOR implementation to commander Allied Forces Southern Region (AFSOUTH). AFSOUTH assumed the duties of Joint Force Commander until October 1999 when the role was changed to “supporting headquarters.” In January of 2001, commander AFSOUTH resumed Joint Forces Commander responsibilities. Up until May 2000, SACEUR was US Army General Wesley Clark who was replaced then by US Air Force

General Joseph Ralston. General Clark had a much more hands on involvement in KFOR activities than Ralston.

The KFOR operation presented the US forces (particularly the US Army) with some interesting command arrangement challenges. The US found themselves in both a support and lead role. As the lead nation for Multinational Brigade East [MNB(E)], the US commander reported to commander KFOR, a non-US military officer with a multinational command staff. As commander MNB(E), he found itself in both a joint and combined operations situation. The US element of MNB(E), referred to as Task Force Falcon (TFF), was built around a US Army brigade with US augmentations from the First Infantry Division, National and European theatre level intelligence organizations, and supporting military organizations such as Aviation, Engineers, Signal, MPs, Medical, Special Operations Forces, Civil Affairs, and PSYOP. These elements were the responsibility of the TFF commander as well. There were three non-US battalions (Russian, Polish and Greek) and several other non-US troop committing nations' military personnel assigned to MNB(E). The non-US battalions were responsible for their own MNB(E) sectors and the commanders reported to the MNB(E) commander. This meant there would be situations where non-US elements would be reporting to US commanders and there would also be situations where US units would be reporting to non-US commanders.

As a complex multinational brigade, there were doctrinal, procedural, and linguistic challenges introduced that required time for the US brigade elements to adjust to operationally. Language alone was a major challenge. Although English was the language of KFOR operations, English was not spoken by all multinational troops participating. Few Russians troops supporting MNB(E) spoke English. During EUROCORPS participation, they provided the commander of KFOR and a number of their officer's filled key KFOR headquarters positions. The language of operations for EUROCORPS was French. Although pre-deployment training included the use of English, some EUROCORPS officers were not fluent in English and there were occasional miscommunications. Additionally, EUROCORPS was not a NATO command element and this was the first time it was employed operationally to support a NATO command structure requiring some adaptation as it was integrated into the KFOR operation.

Incorporating Coalition Data in the Model

The chain of command for MNB(E), the US led sector in Kosovo, is shown in Figure 2. This command structure was used to validate the behavior of the model, i.e., the model could correctly assign attributes to the nodes and links, identify the links between the nodes, and sort the links on an indicated attribute. To implement this organization chart in the model, the billets shown in the shaded boxes were defined as nodes and the interconnections between them were defined as links. In this case, a link attribute was defined as the type of command authority, which was important in the Kosovo example, because national influences prevented the NATO commander from executing Operational Control (OPCON) and achieving unity of command. As a result, COMKFOR employed

consensus building as a means to try to achieve unity of effort. In the US sector, the US commander had full command authority over the US forces but a modified version of OPCON for the NATO member nations assigned, and even less control for non-NATO forces assigned. Achieving operational effectiveness was problematic due to the complex multinational command arrangements, ill-defined states of command for peace operations, and national influences. The model correctly implemented this command structure; this verified the behavior of the model in creating node and link attributes and sorting the links based on command authority.

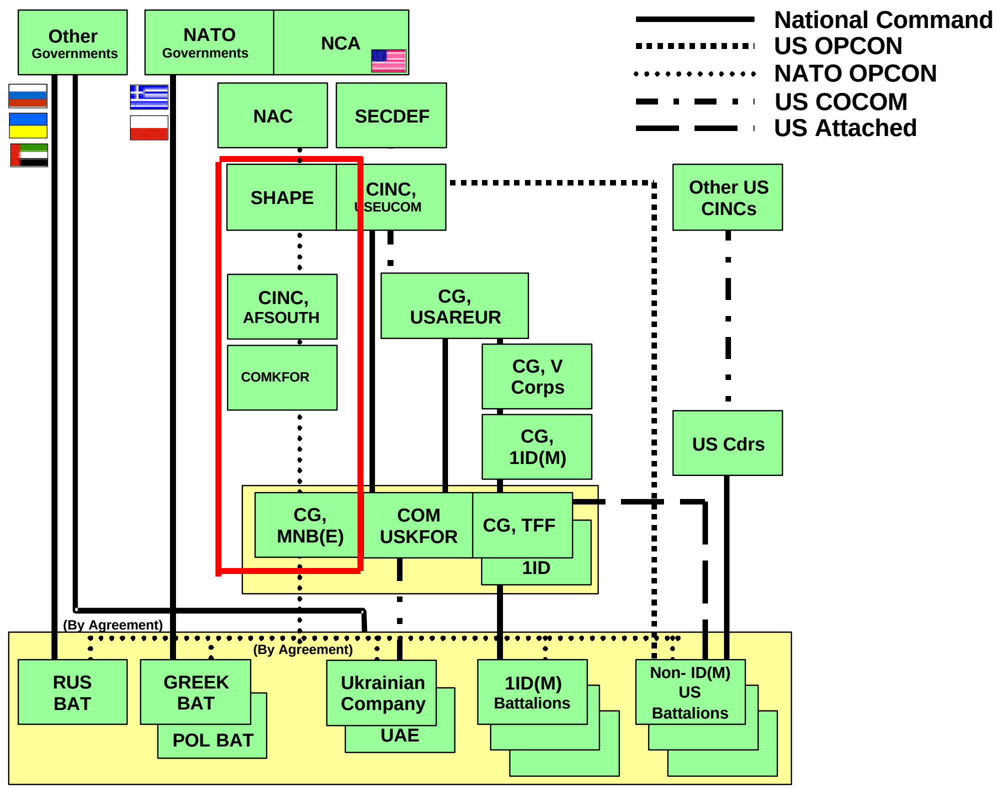

Figure 2: US Sector Chain of Command in Kosovo

In order to execute time-based changes to the coalition structure, a vignette, or small scenario, was developed for one portion of the command structure, as shown by the box in Figure 2 that contains the four command blocks SHAPE, AFSOUTH, COMKFOR, and CGMNB(E), which form a subset of the chain of command. The changes to these nodes and their attributes that occurred from June 1999 to December 2000 are shown in Figure 3. These changes induce seven different states for this command chain.

The rotation of military units every six-months in Kosovo was not unique to the US but occurred for other troop contributing nations as well, and these changes created serious organization turbulence and continuity of operations challenges. Additionally, some commanders were changed even more frequently than the units, e.g., there were four MNB(E) and three COMKFOR commanders in the first year of operation. Commander

priorities and interests and style and modes of operation differed and these too introduced leadership and operational challenges that needed to be accommodated. Changing commanders and staff also made it difficult to maintain established trust relationships within the multinational military organization elements and with the civil agencies and the local population they had to deal with. There were also team-building challenges related to integrating the new military staff and those that did not turn over.

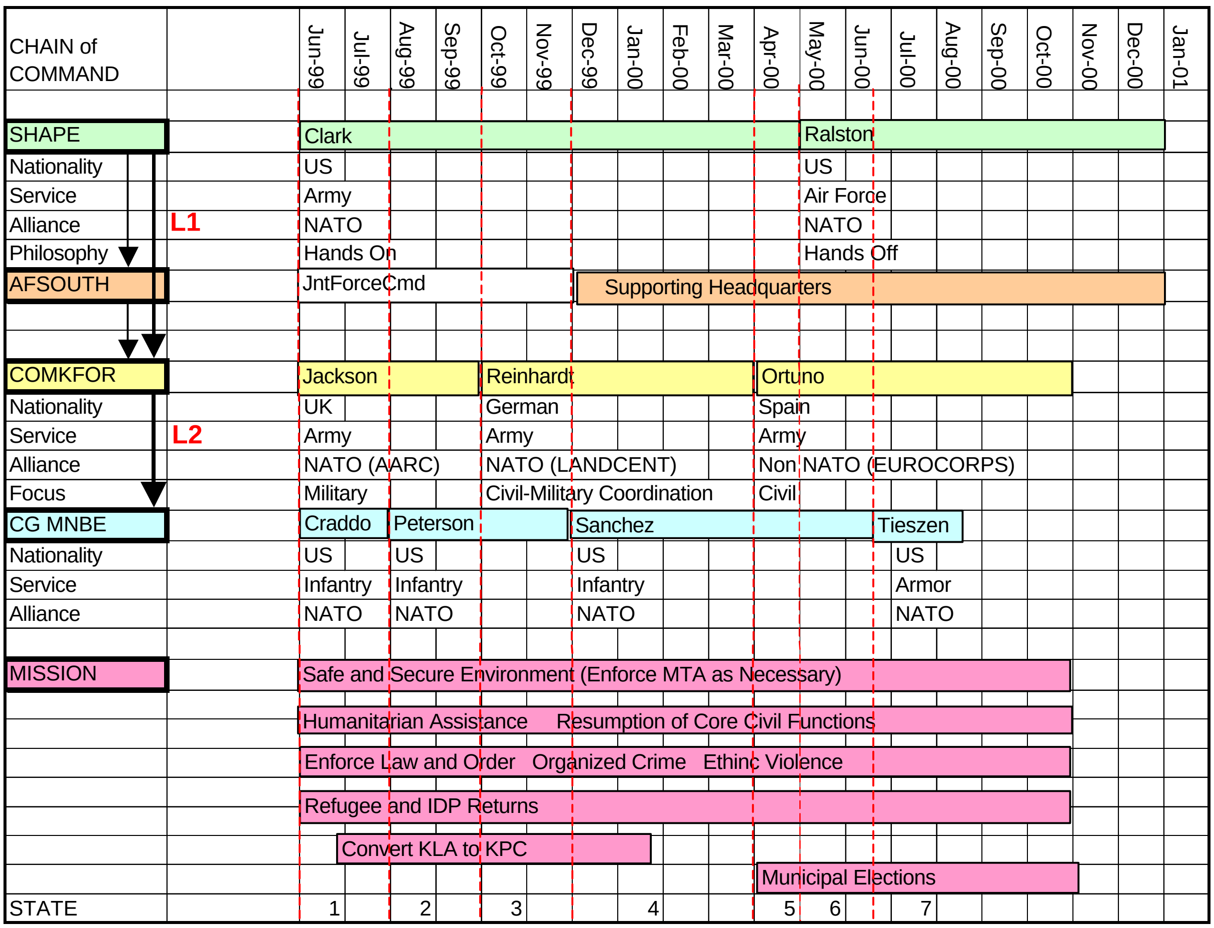

Figure 3: Changes to the Subset Command Structure Vignette

The vignette was used to verify the dynamic behavior of the model by simulating the changes to the nodes over time; the data of Figure 3 was used to populate and stimulate the model. Each time a billet changed, the model of Figure 1 executed. Three nodes were defined in the model: SHAPE, COMKFOR and CGMNBE. Each of these nodes was given three attributes: Nationality, Service and Alliance. Two links were defined, L1 between SHAPE and COMKFOR and L2 between COMKFOR and CGMNBE. An input scenario was created that stepped the model through the seven different states defined in Figure 3. For each state change, the node that changed was input to the model along with its attribute values. At each change the model retrieved the changing node and updated its attribute values. It then retrieved the links that the node was involved in. For each link the link strength measure was recomputed and output.

The dynamics of the model can be illustrated, for example, when the state changed from state two to state three. At state three, the input node to the model was COMKFOR with a new value of “Reinhardt” and with attributes of “German”, “Army” and “NATO”. The model retrieved the node COMKFOR, changed the value from “Jackson” to “Reinhardt” and the Nationality attribute from “UK” to “German”. The attributes of Service and Alliance remained unchanged with values of “Army” and “NATO” respectively. Next the model retrieved the set of links for node COMKFOR: L1 and L2. Each link is processed separately. The nodes of L1 (COMKFOR and SHAPE) were retrieved and compared by attributes: Nationality was different but Service and Alliance attributes were the same, therefore L1 received a link strength indicator of +2. The nodes of L2 (COMKFOR and CGMNBE) were then retrieved and compared. Again the attribute of Nationality was different but the other two attributes were the same; L2 also receives a link strength indicator of +2.

The link strength indicator is a user-defined measure that simply indicates the number of attribute values that are identical for the link’s nodes; it is implemented in the model of Figure 1 as a rule set on the output place. As the attributes change over time, the link strength indicator will increase if the set of nodes becomes more similar on the set of attributes, or decrease if the changes make the set of nodes more dissimilar. The link strength is offset with value of +1, indicating that a link exists between the nodes, before it is output from the model as the link strength measure. In the example above, the link strengths of L1 and L2 with the offset value included are both +3. Currently this indicator simply denotes the similarity between the set of nodes on the link; however, it can later be developed into a surrogate measure for other coalition features, such as interoperability, by including rules that evaluate the effect of the changes to the links. Figure 4 shows the results of the initial simulation of the model with the vignette.

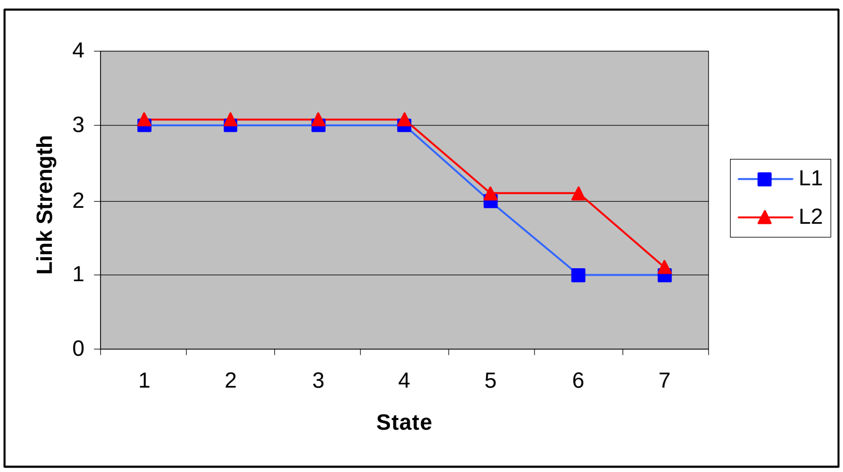

Figure 4: Link Strength Measure

As indicated in the graph, the changes in the early states of the vignette are relatively stable, while more volatile changes occur in the later states: the change to a non-NATO commander as COMKFOR, the change from a US Army to a US Air Force general as

SACEUR, and the change from a US Infantry to an Armor Brigade commander and units at the MNB(E) level all had an impact to the command arrangements and operations as was also noted by observers. Additionally, these changes coincided with an increase in tension throughout Kosovo and a forecast of possible increases in hostilities as the first year of KFOR approached. By using the vignette, the dynamic behavior of the model is validated. It is important to note that there are no performance measures of the coalition at this stage, as the coalition model is not simulating the coalition completing the mission. The current results are limited to indicating how changes to the nodes over time affects the coalition's structure by monitoring the effect of the change on the interconnections between the nodes.

Conclusions

While previous modeling efforts in the Adaptive Architectures for Heterogeneous Command Center program emphasized modeling and experimentation, this current effort emphasizes analyzing actual scenario information and theory building. By using small vignettes of actual coalition experiences, segments of the dynamic coalition model can be built and validated in order to develop useful theories on coalition adaptation. By creating a dynamic model, conclusions can be drawn on how changes in the coalition over time affect the organizational structure. The initial vignette introduced time-based changes to the nodes, which resulted in changes to the characteristics of the links. Future work will extend the link measures to evaluate interoperability and collaboration requirements as the link characteristics change.

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